ATTACHMENT I

Re: DEEP WELL PERMIT
No. 1979-UIC-3-C

IL-060-08

GROUND-WATER INVESTIGATION

AT THE

ALLIED CHEMICAL CORPORATION PLANT SITE

DANVILLE, ILLINOIS

GERAGHTY
& MILLER, INC.

Consulting Ground-Water Geologists and Hydrologists

NORTH SHORE ATRIUM
6800 JERICHO TURNPIKE
SYOSSET, NEW YORK 11791

GROUND-WATER INVESTIGATION

AT THE

ALLIED CHEMICAL CORPORATION PLANT SITE

DANVILLE, ILLINOIS

INTRODUCTION

In April 1979, the Specialty Chemicals Division of the Allied Chemical Corporation retained Geraghty & Miller, Inc. to conduct a ground-water investigation at the Allied plant site in Danville, Illinois. The purpose of the work was to assess the ground-water quality impacts of two abandoned waste disposal areas, an active effluent pond and possible storm sewer leakage. In addition, Geraghty & Miller, Inc. was to provide recommendations concerning the closure of the active effluent pond in terms of the prevailing hydrogeologic conditions at the site.

The field program began with an earth resistivity survey of the plant grounds to establish the general location(s) of possible ground-water contamination. This was followed by the installation of monitoring wells at selected locations on Allied property. Water levels and water samples were obtained from these wells to provide data on ground-water flow and chemical quality. This report contains the project data, findings, conclusions, and recommendations.

CONCLUSIONS

1. The Danville plant site is underlain by 5 to 9 feet of silty clay to clayey silt (soil and loess), which changes to silty and sandy clay, with occasional sand and gravel seams (glacial till). This glacial till becomes dense and dry by depths of about 20 feet. According to available boring data, this condition persists to depths of 60 feet.

2. Water-level elevations measured in the monitoring wells indicate the water table slopes to the west and northwest across the plant area, with a localized depression of water levels in the vicinity of the sump and ditch on the west side of the active effluent pond. The absence of mounding in the water-table contours beneath the active pond, and the pond elevation of about 4 feet above these contours, shows that the pond is not in direct contact with the water table.

3. The horizontal permeability of the glacial materials above the dense till, as determined from sample cores, averages 3.7×10^{-7} cm/sec (7.9×10^{-3} gpd/sq ft) and the vertical permeability averages 4.3×10^{-6} cm/sec. Using the water-table gradient established from monitoring well water-level data, an approximate horizontal ground-water flow velocity was calculated to be 1.5 cm/yr (0.05 ft/yr).

4. Plots of water-quality data from monitoring wells installed during the study follow a general pattern of highest constituent concentrations in the vicinity of the process area, the buried waste materials, and the active effluent pond, with concentrations decreasing to background levels well within the plant property boundaries.

5. The occurrence of carbon tetrachloride as a separate liquid phase is apparently limited to the process area of the plant. Considering the slow ground-water velocity, there is no imminent threat of ground water contaminated with carbon tetrachloride migrating away from the main plant area and off Allied's property. Moreover, any downward movement of contamination past the upper glacial materials will be effectively retarded by the underlying dense till.

6. Contaminated ground water in the vicinity of the active effluent pond is restricted to a narrow strip around the north, east, and south of the pond. The prevailing north-northwest direction of ground-water flow and the slow ground-water velocity indicate that there is no current threat that the contaminated ground water will move off Allied's property. The dense till will effectively retard downward movement of contamination.

7. As the chemical data from monitoring wells became available, it was evident that the localized nature of the contamination, combined with the ample block of Allied-owned property around the affected plant area eliminate the need for drilling and/or sampling outside of Allied's property to identify or track the contamination.

RECOMMENDATIONS

1. Sample Wells W-1, W-2, W-5, W-9, W-26, and W-29 for carbon tetrachloride twice a year (see Plate 10).

2. Allied may proceed with plans to close the active effluent pond. Closure of the pond will entail draining the liquid, covering with clean fill, capping with low-permeability material, and final grading to promote precipitation runoff to the storm drain system.

3. Continue to monitor water quality in Wells W-1, W-14, W-16, W-19, and W-40 around the pond twice yearly. Samples should be analyzed for the standard parameters indicated in this report (Plate 10).

4. Sample Wells W-2, W-20, W-23, W-24, and W-30 twice a year to complete monitoring coverage, and analyze the samples for the standard parameters and carbon tetrachloride (Plate 10).

FIELD INVESTIGATION

The earth resistivity survey consisted of four vertical profiles with electrode spacings probing depths up to 115 feet, followed by 48 horizontal profiles with a fixed electrode spacing of 25 feet, chosen on the basis of data from the vertical profiles. This survey (Plate 1) indicated low apparent resistivity values (areas of probable ground-water contamination) around the active effluent pond, and in the vicinity of the deep disposal well. The resistivity survey provided guidance in establishing the locations of the initial monitoring wells. Tabulated results of the resistivity survey are included in Appendix A.

A total of 44 monitoring wells were installed during the investigation by Test-Cor, Inc. (El Paso, Illinois) using an 8-inch diameter hollow stem auger. Split-spoon core samples were taken at selected intervals during drilling to provide descriptions of the earth materials penetrated, and three Shelby tube core samples were taken at Well W-5 to determine horizontal and vertical permeability. The wells were completed by setting a 2-inch inside diameter slotted pipe inside the auger, backfilling around the slots with gravel, pulling the augers, and backfilling to the surface. Well construction details, well logs, and permeability data are included in Appendix B.

PVC pipe was used for Wells W-1 through W-31 with steel pipe used in the process area wells (W-32 through W-41). Clusters of two and three wells were installed at locations W-4 and W-21 to provide water quality data from different vertical zones below the water table. The completed wells were surveyed to a mean sea level datum by Berns, Clancy and Associates of Urbana, Illinois.

An existing dug well located on the northern portion of the plant property was used to provide supplemental water-level and chemical quality data. This well is 36 inches in diameter, brick-lined, and was taped to 36 feet below land surface. No records on age or well construction were available.

During well construction, water samples from the monitoring wells were analyzed by the Danville plant lab to supply preliminary water quality data and aid in locating subsequent monitoring wells. After all the wells were completed, water samples were collected and sent to Penn Environmental Consultants (Pittsburgh, Pennsylvania) for analysis (Appendix C). A description of the laboratory's analytical techniques and qualifications is included as Appendix D.

GROUND-WATER CONTAMINATION

Carbon Tetrachloride

The occurrence of carbon tetrachloride in ground water is centered around the Well W-21 location (Plate 3). Bailed samples from Well W-21C, which taps the lower part of the glacial till above the dense till, contained carbon tetrachloride liquid with virtually no water. The chemical analyses for this well reflect the nature of this liquid, and do not necessarily represent ambient ground-water quality. Carbon tetrachloride liquid was also detected in Wells W-21B, 11, 32, 33, 34, 35, and 38.

It is reasonable to attribute the presence of carbon tetrachloride in the ground water in the vicinity of Well 21 to leakage from railroad tank cars, spillage during unloading activities, and/or leakage from the carbon tetrachloride storage tank because the concentrations of carbon tetrachloride decrease radially away from these areas. Carbon tetrachloride is heavier than water, and would tend to accumulate as a separate phase below the water table. Attempts at measuring the ground water/carbon tetrachloride interface using an oil-sensitive indicator paste yielded interface depths ranging from 20 feet in Well W-38 to 11 feet in Well W-11. The liquid depth in Well 21C, which has no water on top of the carbon tetrachloride liquid, was measured directly to be 7 feet. These measurements do not necessarily reflect the actual level of carbon tetrachloride in the ground, and may be influenced by the pressure surface of the carbon tetrachloride liquid as part of a two-phase flow sytem.

Carbon tetrachloride concentrations in ground water decrease significantly to background levels of less than 10 ug/l in all directions outside the carbon tetrachloride handling area. The presence of carbon tetrachloride at detectable concentrations in upgradient and outlying downgradient wells indicates that this man-made chemical evidently exists at background levels in the area's water table. Recent research indicates that carbon tetrachloride is becoming more common in the environment and has been measured in rain (California), 2.8 ug/l; snow (North America), 0.3 to 2 ug/l; untreated surface-water reservoir, 1.4 ug/l; raw water supplies (USEPA Region 5), <1 ug/l to 20 ug/l*. It is reasonable to expect then, that monitor-

* "Chloroform, Carbon Tetrachloride, and Halomethanes: An Environmental Assessment," National Academy of Sciences, Washington, D.C., 1978.

ing wells on Allied's property which are outside of the influence of materials handling and storage-related sources of carbon tetrachloride may be affected by trace quantities of this chemical introduced in the ground-water regime through normal precipitation.

The chemical concentration contour map (Plate 3), and field observations indicate that the occurrence of carbon tetrachloride as a separate liquid phase in the ground water is a very localized condition and is limited to the process area of the plant. This area lies inside the plant fence line, and is well within Allied's property boundary. We do not believe that there is any significant threat of carbon tetrachloride migrating away from the main plant area and off of Allied's property. However, periodic sampling of selected monitoring wells at the perimeter of the area where carbon tetrachloride was found will be necessary to provide continuing data on any movement and/or change in the nature of this contamination. This could be accomplished by sampling Wells W-1, W-2, W-5, W-9, W-26, and W-29 twice yearly and analyzing for carbon tetrachloride.

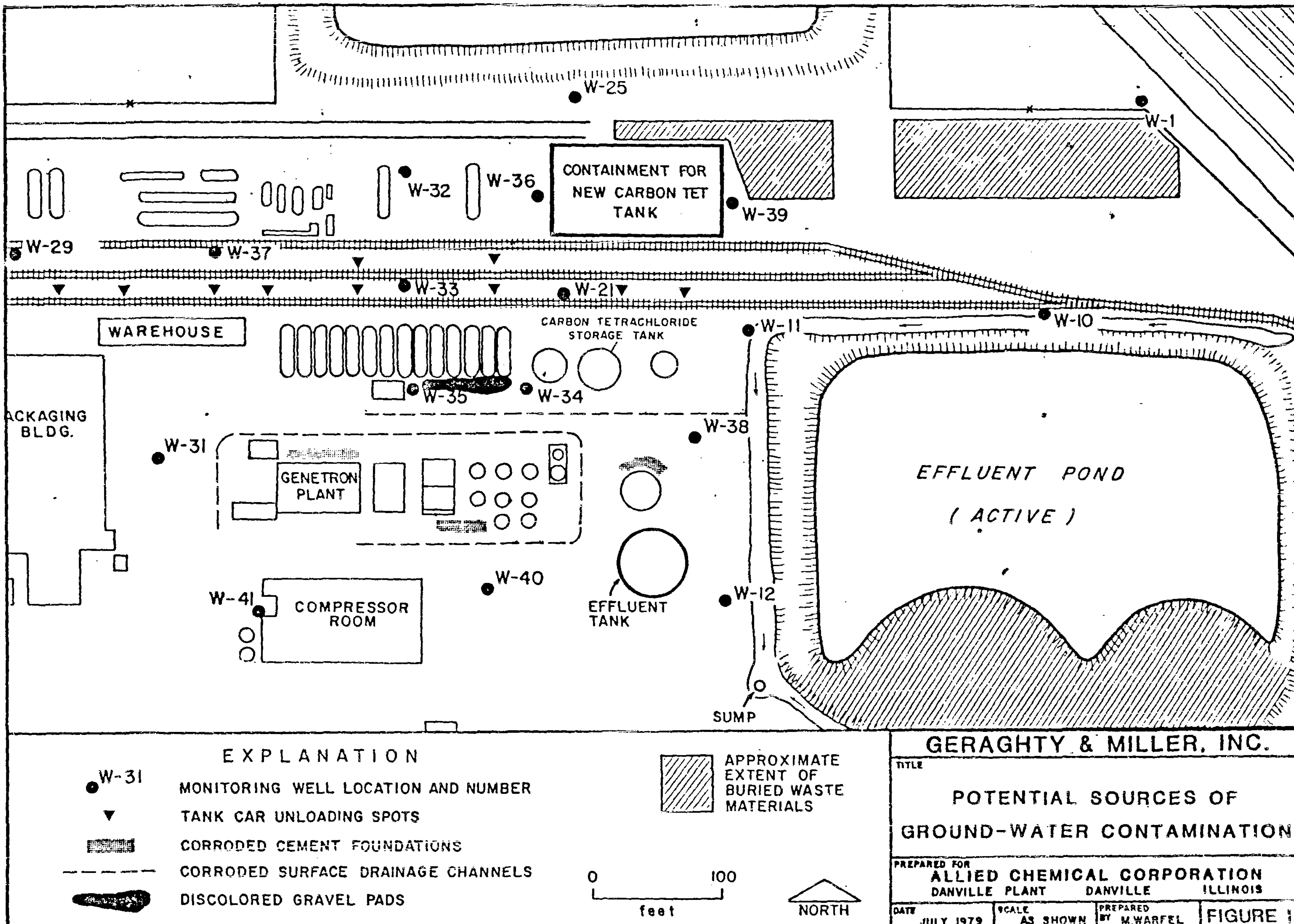
Active Effluent Pond

Contour maps of chemical concentrations in the vicinity of the active effluent pond (Plates 3 through 9) show that contaminated ground water is apparently restricted to a narrow band around the pond on the north, east, and south, extending towards the major area of contaminated ground water beneath the plant process area to the west of the pond. Moreover, there is no evidence to indicate that the pond is contributing to the carbon tetrachloride problem. Due to the ground-water flow direction (northwest and west) and the slow ground-water velocity, there is no immediate threat of contaminated ground water around the pond moving off the plant property. In order to eliminate continued leakage from the pond, we believe that it should be drained, filled, capped with low-permeability material, and graded to promote the runoff of precipitation to the storm drain system.

In order to provide continuing data on ground-water quality in the vicinity of the pond, it will be necessary to implement a periodic sampling program at Wells W-1, W-14, W-16, W-19, and W-40. These wells should be sampled twice each year for acidity, sulfate, chloride, fluoride, antimony, arsenic, pH, and specific conductance.

Potential Sources of Ground-Water Contamination

Contaminated ground water (e.g. ground-water quality departing from background) beneath the plant area can be attributed to the combined effects of the sources shown in Figure 1. While the carbon tetrachloride area and the active effluent pond are the most evident sources, the surface drainage channels in the process area will allow chemicals to seep into the ground and subsequently contact the water table. Chemical spills are another factor, especially in the vicinity of the tank car unloading areas and the acid and caustic storage tanks near Well W-35. Since some of the plant area is constructed on gravel fill, chemicals spilled on unpaved surfaces will seep through the gravel into the underlying natural glacial materials. The disintegrating concrete foundations noted on Figure 1 also provide a path for chemicals to move into the ground.



GERAGHTY & MILLER, INC.

TITLE

POTENTIAL SOURCES OF
GROUND-WATER CONTAMINATION

PREPARED FOR
ALLIED CHEMICAL CORPORATION
DANVILLE PLANT DANVILLE ILLINOIS

DATE	SCALE	PREPARED BY	
JULY 1979	AS SHOWN	M. WARFEL	FIGURE 1

Total Monitoring Program

The monitoring programs proposed for the carbon tetrachloride and pond areas should be augmented by sampling Wells W-2, W-20, W-23, W-24, and W-30 twice yearly and analyzing the samples for all parameters, including carbon tetrachloride. This will provide adequate coverage of the property perimeter in both the upgradient and downgradient directions. These wells were chosen on the basis of their location with respect to sources of contamination and the direction of ground-water flow as indicated by the June 11, 1979 water-table contour map. A summary of the entire proposed monitoring well program is given in Table 1, and the locations of the wells to be monitored are shown on Plate 10.

HYDROGEOLOGY

The Allied Chemical Corporation Danville plant is located on the east side of Danville, Illinois, about one-half mile west of the Indiana state line (Figure 2). Land surface elevations at the site range from about 656 feet at Well W-24 in the southeast corner of the property to 645 feet at Well W-22 in the northwest portion of the site. The land slopes gently north and west towards Lick Creek, which flows about 0.7 mile west of the plant.

Geologic samples from the monitoring wells indicate that the site is underlain by 5 to 9 feet of light brown silty clay to clayey silt (soil and loess). One to 3 feet of gravel fill was encountered on top of the loess in the main plant area. A change to brown silty to sandy clay, with some gravel and occasional sand seams (glacial till) occurs below the loess. This

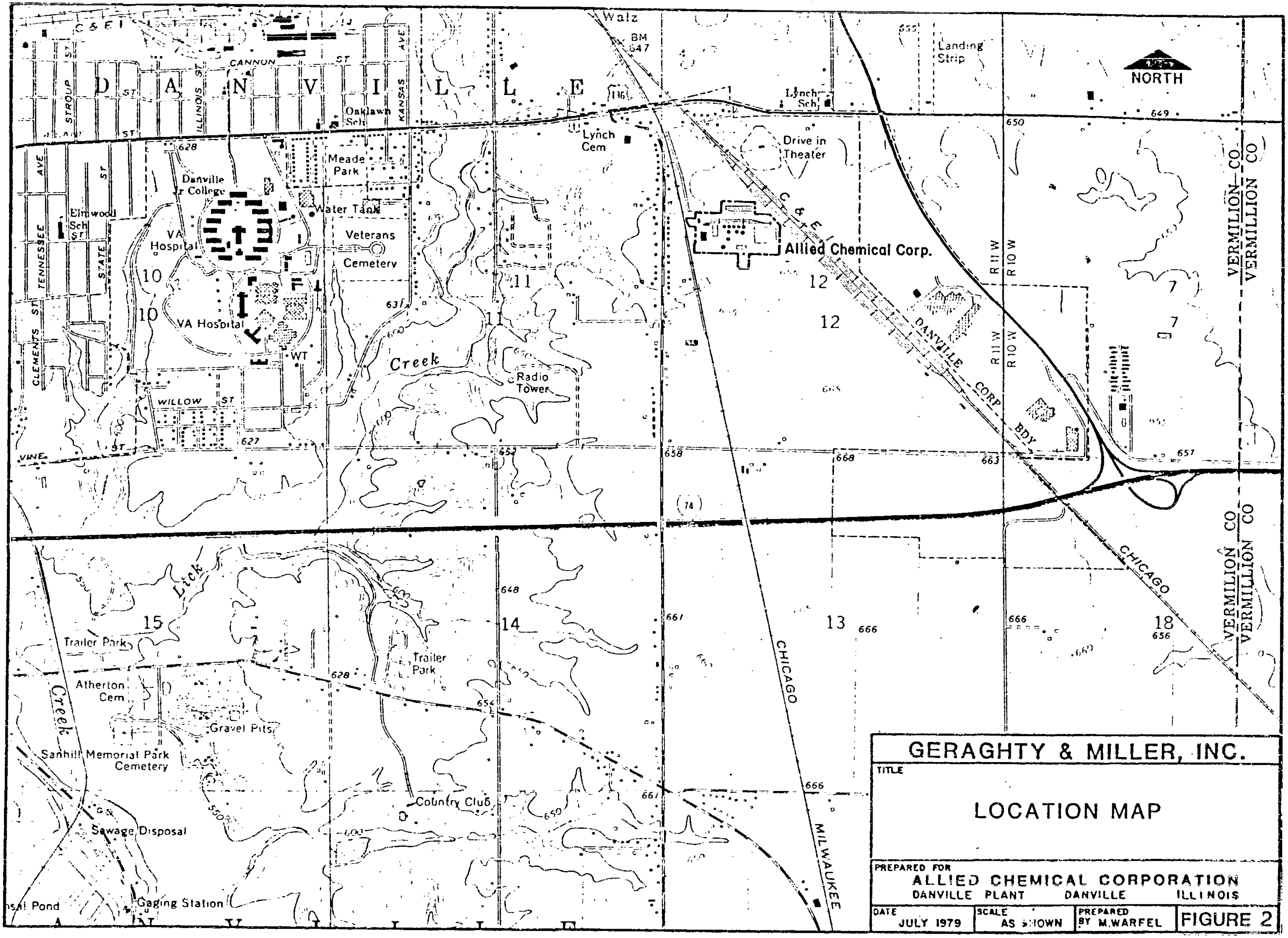
Table 1. Proposed Ground-Water Monitoring Program, Allied Chemical Corporation, Danville, Illinois.

Well No.	Analyses
W-1	Standard Parameters and Carbon Tetrachloride
W-2	Standard Parameters and Carbon Tetrachloride
W-5	Carbon Tetrachloride Only
W-9	Carbon Tetrachloride Only
W-14	Standard Parameters Only
W-16	Standard Parameters Only
W-19	Standard Parameters Only
W-20	Standard Parameters and Carbon Tetrachloride
W-23	Standard Parameters and Carbon Tetrachloride
W-24	Standard Parameters and Carbon Tetrachloride
W-26	Carbon Tetrachloride Only
W-29	Carbon Tetrachloride Only
W-30	Standard Parameters and Carbon Tetrachloride
W-40	Standard Parameters Only

Notes:

Standard Parameters: Acidity, Sulfate, Chloride, Fluoride, Antimony, Arsenic, pH, Specific Conductance

Sampling Interval: Twice a Year



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TITLE

LOCATION MAP

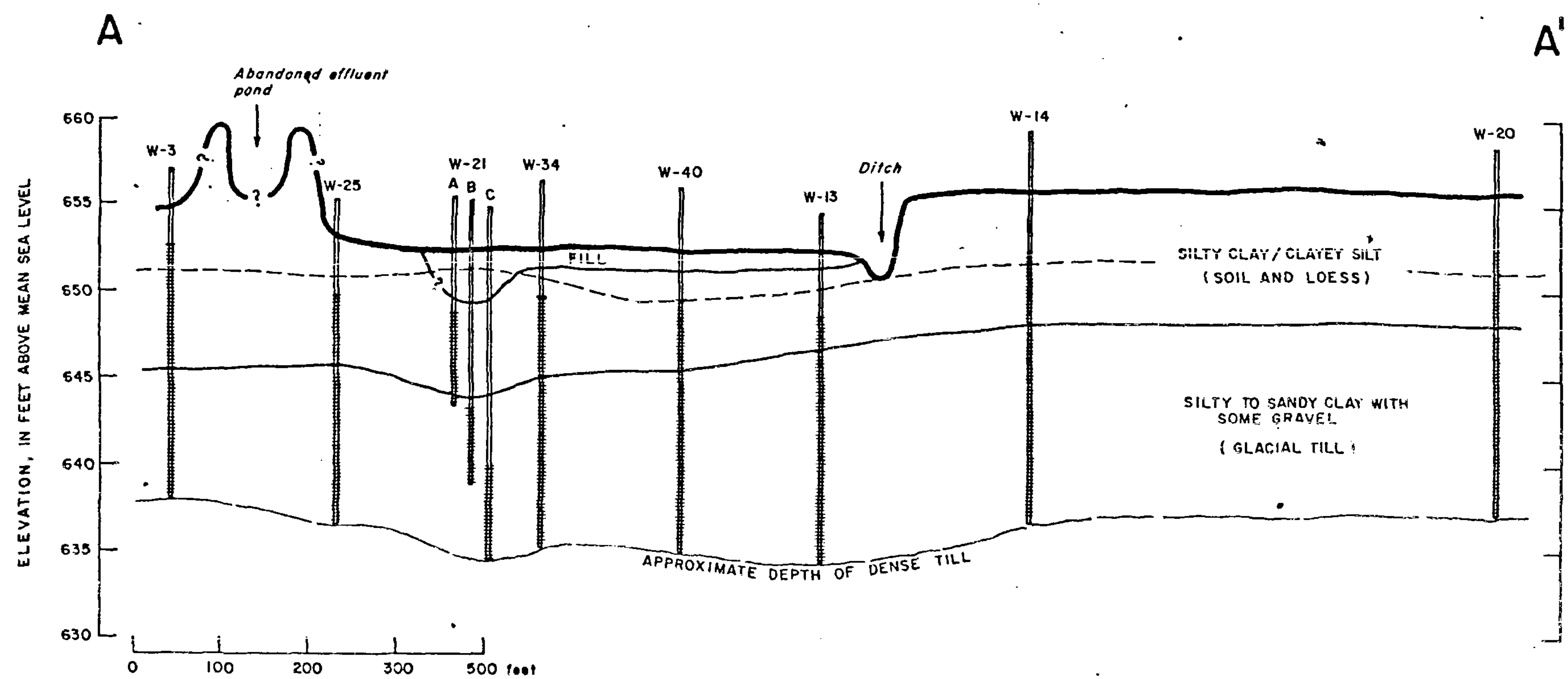
PREPARED FOR
ALLIED CHEMICAL CORPORATION
DANVILLE PLANT DANVILLE ILLINOIS

DATE	SCALE	PREPARED BY	
JULY 1979	AS SHOWN	M.WARFEL	FIGURE 2

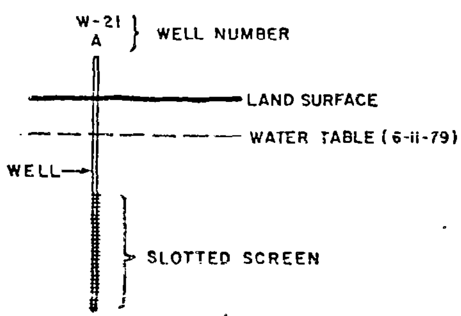
till grades to a gray color and becomes dense and dry at about 20 feet below land surface (approximate elevation 635 feet). No monitoring wells were drilled beyond this depth because of the extremely hard nature of the till. However, test borings previously completed on plant property indicate that this dense till persists to a depth of at least 60 feet in the immediate area of the plant.

Ground water in the completed monitoring wells is found at depths ranging from 2 to 12 feet below land surface at the southeast and northwest portions of the property, averaging 2 to 4 feet below ground in the immediate area of the plant. The cross sections in Figures 3 and 4 illustrate the relationships between the site geology and the water table. Water levels in the monitoring wells corrected to sea level datum indicate a corresponding range in water-table elevations from near 654 feet in the southeast corner of the property to about 637 feet in the northwest near Brick Road. The plot of water-table elevations shown on the water-table contour map on Plate 2 indicates the water table slopes to the west and northwest across the plant area, with a localized depression of water levels in the vicinity of the sump and ditch on the west side of the active effluent pond. The absence of mounding in the water-table contours beneath the active pond, and the pond level elevation of about 4 feet above these contours, shows that the pond is not in direct contact with the water table. The abandoned effluent pond has no discernible influence on the water table because it was temporarily used once and then drained.

The water-table gradient is fairly flat in the area southeast of the ac-



EXPLANATION



Note: Configuration of land surface in vicinity of abandoned effluent pond is questionable due to lack of topographic data

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TITLE

CROSS SECTION A-A'

PREPARED FOR
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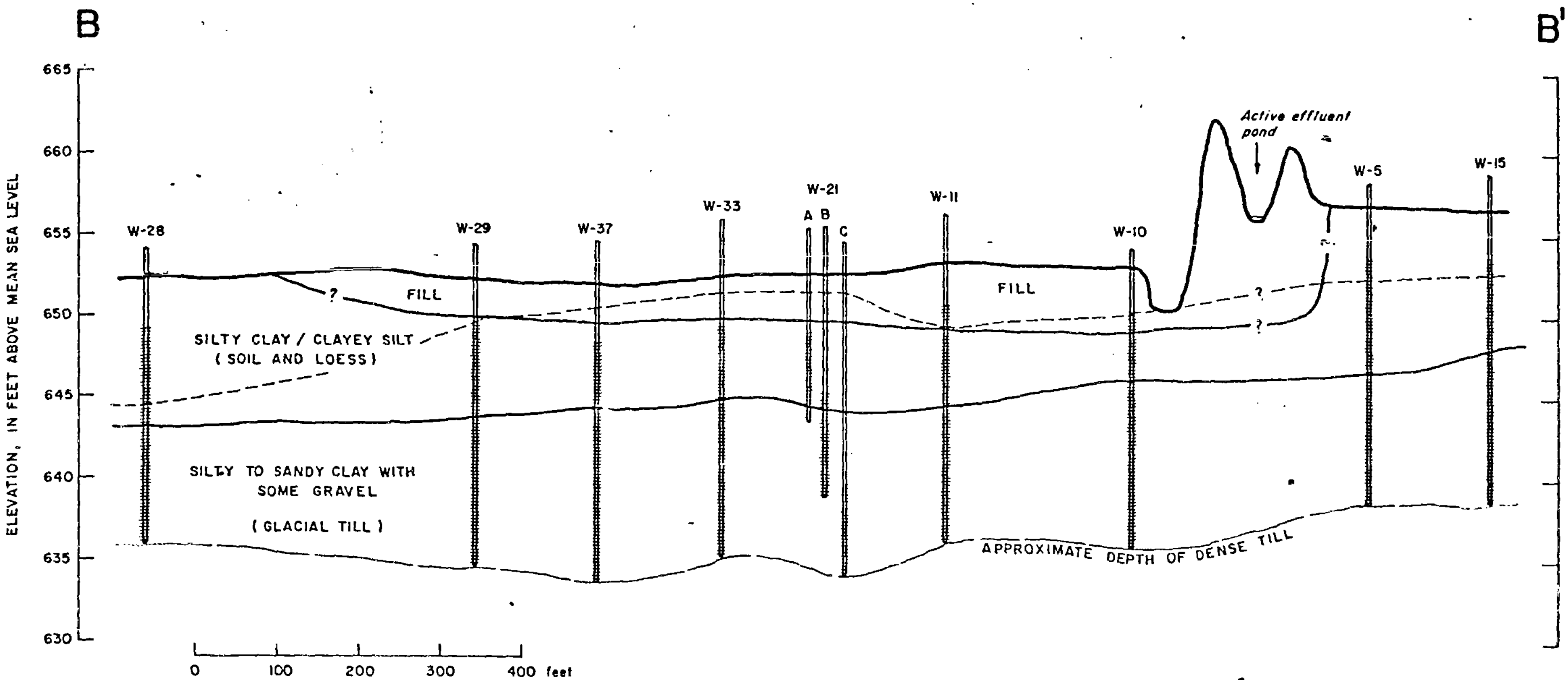
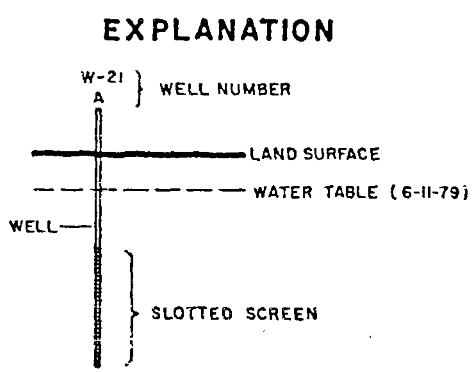
DANVILLE PLANT DANVILLE ILLINOIS

DATE	SCALE	PREPARED BY	
JULY 1979	AS SHOWN	M.WARFEL	FIGURE 3





GERAGHTY & MILLER, INC.

TITLE

CROSS SECTION B-B'

PREPARED FOR
ALLIED CHEMICAL CORPORATION
DANVILLE PLANT DANVILLE ILLINOIS

DATE	SCALE	PREPARED BY	
JULY 1979	AS SHOWN	M.WARFEL	FIGURE 4

tive effluent pond, but becomes steeper towards the northwest, as well as in the immediate vicinity of the sump. Using a representative gradient from the area of the plant office of 0.013 ft/ft, an average horizontal permeability determined from the laboratory tests for the saturated section of loess and till of 7.9×10^{-3} gpd/sq ft, and an approximate effective porosity value from the available literature of 10 percent, the travel time of ground water beneath the plant area is calculated to be 0.05 ft/yr. This is an unusually slow velocity, compared to travel times in clean sand on the order of 100 to 1,000 ft/yr.

Ground-Water Quality

Results of the water sample analyses performed by Penn Environmental Consultants (Appendix C) were used to construct the chemical concentration contour maps shown on Plates 3 through 9. The contours of the various chemical parameters plotted on these maps follow the same general pattern of highest constituent concentrations in the vicinity of the process area, the buried waste materials, and the active effluent pond, with concentrations decreasing to background levels within short distances of the fence line bounding the main plant area. Wells W-20 and W-24 are cross-gradient and upgradient, respectively, from the rest of the plant property and represent background ground-water quality. The perimeter wells along the south and east borders of the property are outside of the influence of the plant's contamination sources.

It is reasonable to expect the highest constituent concentrations beneath and downgradient of the buried waste materials, the active pond, and process area. However, the contour pattern also exhibits a characteristic "bulge" immediately to the east and southeast of the active pond. Although this area lies slightly upgradient from the pond, the water table here is very flat (Plate 2) and may still show the effects of a previous ground-water mound beneath the pond. There are also indications that surface drainage from the ditch on the south side of the pond could have backed-up past Well W-7 and towards Well W-6 during periods of excessive rainfall.

A second lobe in the contour pattern that is evident on the maps of specific conductance, chloride, and sulfate, as well as the resistivity survey map, extends around the immediate area of the deep disposal well. This could be the result of surface leaks and spills occurring as waste materials have been transported to the deep well prior to disposal. It is also possible that at sometime in the past there was a southwesterly component in the water-table gradient from the vicinity of the active effluent pond towards the well draining in that direction. Such a gradient would require a slight shift in the contours of the current water-table map shown in Plate 2, which could have been the case if the sump in the pond ditch was not pumping, thus eliminating the water-table depression around this sump.

A few anomalies in chemical concentrations are evident on the contour maps. Concentrations of sulfate at Wells W-27 and W-30 (Plate 8) are slightly higher than the 100 mg/l contour which bounds the plant area. This difference could be attributed to the laboratory analysis, since other parameters like chloride and specific conductance do not show a corresponding increase at this sampling location. The higher sulfate value at Well W-30 may be an indication of the possible southwesterly water-table gradient described above, as the chloride for this well is slightly higher than other perimeter wells. Drainage tiles reportedly buried in the farm field between Well W-30 and the main plant area could also carry contaminated ground water in this direction, especially if the tiles run towards the small stream just to the southwest of Well W-30.

Single well anomalies also appear on the chloride contour map (Plate 6) at Wells W-28 and W-36. Chloride concentrations in these wells are lower than the surrounding contours, which may be attributed to the laboratory results, since the corresponding values for specific conductance do not show this same radical decrease.

Although the chemical data for the upgradient Well W-24 fit the contour patterns of the various parameters, the values of specific conductance, chloride, and sulfate for this well are slightly higher than levels of these constituents in other perimeter wells downgradient from Well W-24. This well also yielded a small but detectable level of carbon tetrachloride. Although this well should represent background ground-water quality, it may be affected by activities at the adjacent railroad yard, where tank cars containing carbon tetrachloride are routinely left standing on the track nearest to Well W-24, creating the potential for contaminated ground water in the vicinity of the railroad yard.

There is also the possibility that a small industrial area located about 1,500 to 2,200 feet southeast of Well W-24 on the east side of the railroad yard (Figure 2) could influence ground-water quality on Allied's property. Although this area appears to be situated up the prevailing water-table gradient from Well W-24 and Allied's plant, the available information on the geology and water-table conditions in the immedicate vicinity of the railroad yard and the industrial park cannot support any conclusions.

The initial sampling was conducted in June 1979, with a second sampling in August 1979 to confirm some of the analyses which were believed to be unusually high. Results of all water quality analyses and the sampling techniques employed in both sampling runs, are included in Appendix C.

Acidity and arsenic data have not been mapped. The acidity data could not be contoured to form a meaningful pattern, and the pH map presents a better contrast between the process area and background ground-water quality. Arsenic concentrations were not contoured because only one well (W-21C) yielded a value above the detection limit of 0.03 mg/l.

The chemical concentration contour maps are based on a single sampling of the monitoring wells, and the patterns of the contour lines are the result of hydrological interpretations of a single set of data points; thus, lobes or bulges in any of the contour patterns cannot be assumed to represent plumes of ground-water contamination.

Except for the cluster wells installed at locations W-21 and W-4, the slotted sections of all monitoring wells installed during this investigation intercept the entire saturated section of the water table from the water-table surface to the top of the dense till, and samples from these wells represent the average chemical quality of the ground water within the water table. As is evident from the cross section in Figure 5, the cluster wells with slotted sections tapping successive intervals of the saturated section (Wells W-4D, W-21B, and W-21C) show that ground-water quality varies within different vertical segments of the water table. For the selected chemical constituents plotted at the cluster well locations, sulfates and carbon tetrachloride concentrations increase with depth, while chloride, fluoride, and antimony levels remain the same or decrease slightly. The overall distribution in ground-water quality as depicted in the cross section remains the same as shown by the chemical contour maps; with high concentrations in the vicinity of the plant process area which decrease to near background levels well within the plant property boundaries.

Respectfully submitted,

GERAGHTY & MILLER, INC.

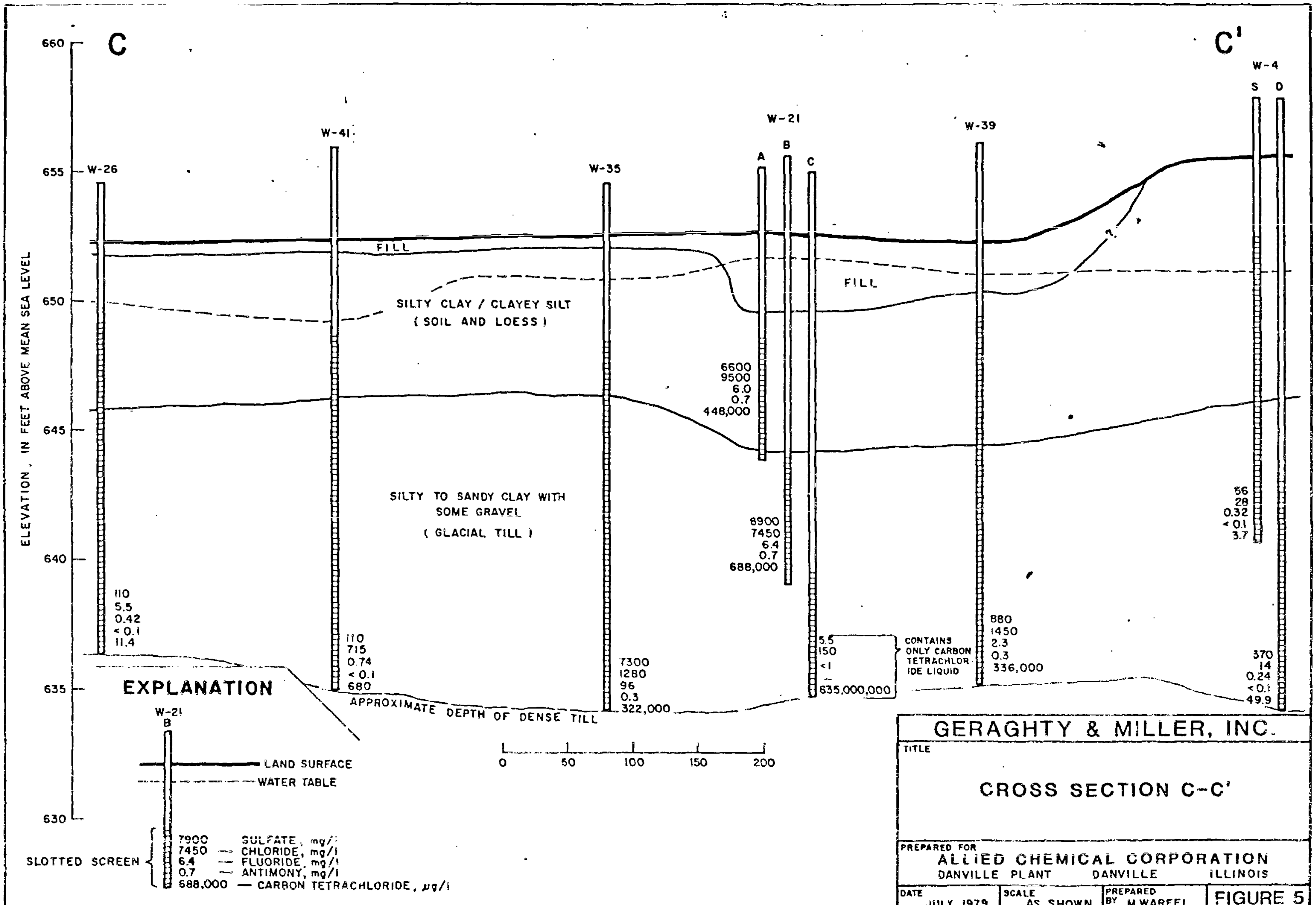
Michael R. Warfel

Michael R. Warfel
Hydrogeologist

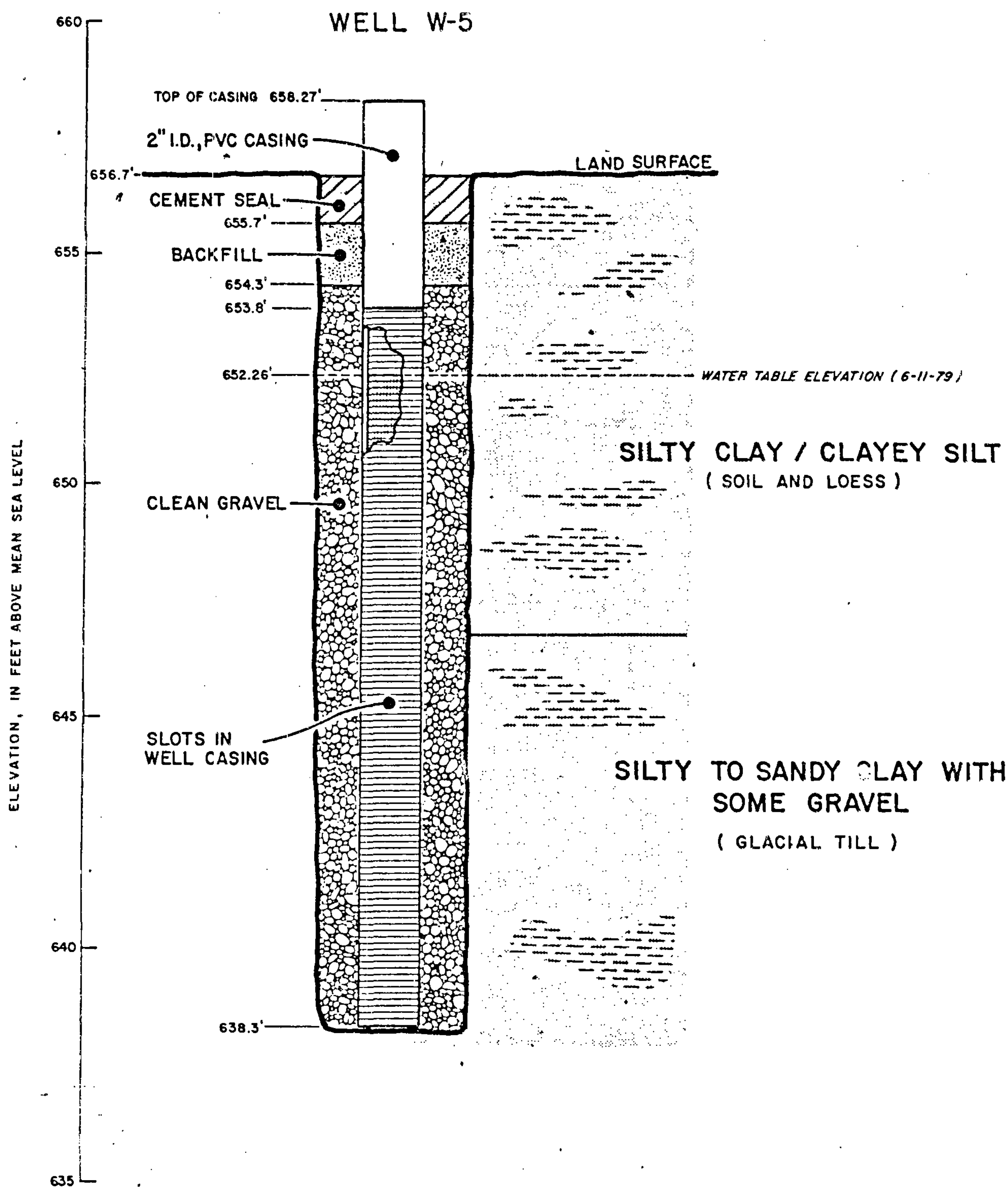
John Isbister

John Isbister
Vice President

September 18, 1979



C
C'
ELEVATION, IN FEET ABOVE MEAN SEA LEVEL
660
655
650
645
640
635
630
W-26
W-41
W-35
W-21
A
B
C
W-39
W-4
S
D
FILL
FILL
SILTY CLAY / CLAYEY SILT
(SOIL AND LOESS)
SILTY TO SANDY CLAY WITH
SOME GRAVEL
(GLACIAL TILL)
6600
9500
6.0
0.7
448,000
8900
7450
6.4
0.7
688,000
56
28
0.32
< 0.1
3.7
110
5.5
0.42
< 0.1
11.4
110
715
0.74
< 0.1
680
7300
1280
96
0.3
322,000
5.5
150
<1
635,000,000
CONTAINS
ONLY CARBON
TETRACHLOR-
IDE LIQUID
880
1450
2.3
0.3
336,000
370
14
0.24
< 0.1
49.9
APPROXIMATE DEPTH OF DENSE TILL
0
50
100
150
200
EXPLANATION
W-21
B
LAND SURFACE
WATER TABLE
SLOTTED SCREEN
7900 SULFATE, mg/l
7450 — CHLORIDE, mg/l
6.4 — FLUORIDE, mg/l
0.7 — ANTIMONY, mg/l
688,000 — CARBON TETRACHLORIDE, µg/l
GERAGHTY & MILLER, INC.
TITLE
CROSS SECTION C–C'
PREPARED FOR
ALLIED CHEMICAL CORPORATION
DANVILLE PLANT DANVILLE ILLINOIS
DATE
JULY 1979
SCALE
AS SHOWN
PREPARED BY M.WARFEL
FIGURE 5



GERAGHTY & MILLER, INC.			
TITLE TYPICAL MONITORING WELL CONSTRUCTION			
PREPARED FOR ALLIED CHEMICAL CORPORATION DANVILLE PLANT DANVILLE ILLINOIS			
DATE JULY 1979	SCALE AS SHOWN	PREPARED BY M.WARFEL	FIGURE B-1

Table B-1. Well Construction and Water-Level Data, Allied Chemical Corporation Plant, Danville, Illinois.

Well No.	Total Depth (feet below land surface)	Slotted Interval (feet below land surface)	Elevation of Land Surface (feet above msl)	Elevation of Top of Casing (feet above msl)	Elevation of Water Table on 6-11-79 (feet above msl)	Elevation of Water Table on 8-15-79 (feet above msl)
W- 1	19.3	2.3 - 19.3	655.3	657.85	651.22	651.37
W- 2	15.5	2.5 - 15.5	652.1	654.10	649.72	649.66
W- 3	16.9	2.4 - 16.9	654.9	657.01	651.21	651.28
W- 4S	15.0	3.0 - 15.0	655.7	657.81	651.24	651.62
W- 4D	21.5	12.5 - 21.5	655.6	657.76	650.82	651.34
W- 5	18.4	2.9 - 18.4	656.7	658.27	652.26	651.85
W- 6	17.7	3.2 - 17.7	656.5	658.63	652.48	652.75
W- 7	17.1	2.6 - 17.1	654.9	657.59	652.48	652.53
W- 8	16.0	3.0 - 16.0	654.4	656.08	652.03	652.10
W- 9	16.9	2.9 - 16.9	653.8	655.96	651.51	651.53
W-10	16.9	2.9 - 16.9	653.0	653.04	650.50	650.68
W-11	17.1	2.6 - 17.1	653.3	656.29	649.07	648.92
W-12	17.6	3.1 - 17.6	652.6	654.53	648.76	648.69
W-13	17.9	3.4 - 17.9	652.3	654.74	650.34	650.02
W-14	19.1	3.6 - 19.1	655.9	659.34	651.92	652.09
W-15	17.7	3.2 - 17.7	656.6	658.85	652.68	652.68
W-16	18.7	3.2 - 18.7	656.6	659.04	652.54	652.49
W-17	17.7	3.2 - 17.7	655.6	658.02	652.43	652.37
W-18	17.5	3.0 - 17.5	655.2	658.17	652.31	652.27
W-19	17.8	3.3 - 17.8	656.2	659.63	652.24	652.20
W-20	17.8	2.8 - 17.8	655.4	658.29	651.07	651.34
W-21A	8.9	3.9 - 8.9	652.7	655.18	651.57	651.06
W-21B	13.5	8.5 - 13.5	652.5	655.65	651.55	651.02
W-21C	17.8	12.8 - 17.8	652.5	654.89	-	-
W-22	16.5	3.5 - 16.5	645.2	648.79	636.92	635.47
W-23	16.4	3.4 - 16.4	652.7	654.77	647.58	648.78
W-24	16.1	3.1 - 16.1	656.4	659.55	653.91	653.61
W-25	16.4	3.4 - 16.4	653.1	655.13	650.97	650.53
W-26	16.0	3.0 - 16.0	652.3	654.51	649.99	649.23
W-27	15.9	2.9 - 15.9	651.2	654.41	640.90	637.80
W-28	16.2	3.2 - 16.2	652.2	654.01	644.40	644.29
W-29	17.3	2.8 - 17.3	652.0	654.44	649.66	648.86
W-30	16.1	3.1 - 16.1	651.6	654.51	648.58	648.64

Note: Wells W-1 through W-30 are constructed of 2-inch ID, PVC pipe.

Table B-1. (Continued)

Well No.	Total Depth (feet below land surface)	Slotted Interval (feet below land surface)	Elevation of Land Surface (feet above msl)	Elevation of Top of Casing (feet above msl)	Elevation of Water Table on 6-11-79 (feet above msl)	Elevation of Water Table on 8-15-79 (feet above msl)
W-31	17.5	3.0 - 17.5	652.3	655.18	649.65	648.99
W-32	17.4	2.9 - 17.4	652.9	656.31	651.12	650.58
W-33	17.2	2.7 - 17.2	652.5	655.95	651.25	650.70
W-34	17.2	3.2 - 17.2	652.7	656.28	650.94	650.64
W-35	18.5	4.0 - 18.5	652.7	654.61	650.90	650.46
W-36	18.3	3.8 - 18.3	652.8	655.47	651.08	650.71
W-37	18.0	3.5 - 18.0	651.8	654.83	650.63	649.99
W-38	18.1	3.6 - 18.1	652.6	655.50	649.35	-
W-39	17.2	2.7 - 17.2	652.4	656.15	651.01	650.98
W-40	17.4	2.9 - 17.4	652.4	655.99	649.71	649.42
W-41	17.5	3.0 - 17.5	652.4	655.87	649.28	649.07
Dug Well	36.0	-	646.0	646.06	640.46	640.16

Note: Wells W-31 through W-41 are constructed of 2-inch ID, black steel pipe.

Table B-3. Permeability Data

Note: Shelby tube samples for the permeability tests were taken from the monitoring well No. W-5 location

Depth (feet below land surface)	Horizontal Permeability (cm/sec)	Horizontal Permeability (gpd/ft^2)	Vertical Permeability (cm/sec)	Vertical Permeability (gpd/ft^2)
4.0 - 4.5	1.6×10^{-7}	3.4×10^{-3}	--	--
4.5 - 4.9	--	--	6.3×10^{-7}	1.3×10^{-2}
11.5 -12.0	8.3×10^{-7}	1.8×10^{-2}	--	--
12.0 -12.5	--	--	3.5×10^{-6}	7.4×10^{-2}
13.0 -13.5	1.1×10^{-7}	2.3×10^{-3}	--	--
13.5 -14.0	--	--	8.9×10^{-6}	1.9×10^{-1}
Averages	3.7×10^{-7}	7.9×10^{-3}	4.3×10^{-6}	9.2×10^{-2}

Geraghty & Miller, Inc.

WELL LOG

Well No. W-41 | Date Completed: 6/5/79

Project: Allied Chemical Corporation | Location: Danville, Illinois

Description	Depth Below Land Surface (feet)	Thickness (feet)
Cinder fill	0.0 - 0.5	0.5
Dark gray to black silty clay (soil)	0.5 - 4.0	3.5
Light brown and yellow mottled clayey silt (loess)	4.0 - 6.0	2.0
Brown silty to sandy clay, with 40% rounded to angular gravel up to 3/4-inch diameter; becoming gray, dense, and dry by 17.5 ft. (glacial till)	6.0 - 17.0	-

Notes: Auguer encountered large cobble, 13.5 ft. - 14.0 ft.

Table C-1. Analyses of Ground Water Samples Taken at the Allied Chemical Corporation Plant, Danville, Illinois, in June 1979.

Well No.	Date	Acidity (mg/l as $CaCO_3$)	Sulfate (mg/l)	Chloride (mg/l)	Fluoride (mg/l)	Antimony (mg/l)	Arsenic (mg/l)	Carbon Tetra-Chloride (ug/l)	pH	Specific Conductance (umhos/cm)
W- 1	6- 8-79	- 450	85	82	1.6	< 0.1	< 0.03	2,030	7.2	1,200
W- 2	6- 8-79	- 410	110	355	0.22	< 0.1	< 0.03	5.3	7.2	1,900
W- 3	6- 8-79	- 570	95	55	0.28	< 0.1	< 0.03	9.6	7.5	900
W- 4S	6- 8-79	- 570	56	28	0.32	< 0.1	< 0.03	3.7	7.4	800
W- 4D	6- 8-79	- 770	370	14	0.24	< 0.1	< 0.03	49.9	7.1	1,600
W- 5	6- 7-79	- 530	220	2,700	0.21	< 0.1	< 0.03	9.7	6.5	11,000
W- 6	6- 7-79	-1,065	530	9,200	340	0.5	< 0.03	2.7	8.4	40,000
W- 7	6- 7-79	- 930	190	2,700	12	0.2	< 0.03	1.3	6.5	10,500
W- 8	6- 7-79	- 178	46	470	12	< 0.1	< 0.03	3.1	7.2	1,850
W- 9	6- 8-79	- 550	57	214	19	< 0.1	< 0.03	30.1	7.2	1,450
W-10	6-11-79	-7,400	650	735	270	< 0.1	< 0.03	34.5	8.5	40,000
W-11	6-12-79	- 480	990	3,525	3.2	< 0.1	< 0.03	364,000	6.5	12,000
W-12	6-11-79	-1,600	170	3,175	27	< 0.1	< 0.03	107	6.8	11,500
W-13	6-11-79	- 450	59	200	0.98	< 0.1	< 0.03	127	7.5	800
W-14	6-11-79	-1,600	140	700	0.27	< 0.1	< 0.03	404	7.2	2,700
W-15	6- 7-79	- 540	170	230	0.32	< 0.1	< 0.03	4.2	7.2	1,650
W-16	6- 7-79	- 560	74	110	0.46	< 0.1	< 0.03	7.2	7.4	1,100
W-17	6- 7-79	- 570	87	215	0.29	< 0.1	< 0.03	3.4	7.3	1,300
W-18	6- 7-79	- 530	52	270	0.22	< 0.1	< 0.03	5.6	7.2	1,300
W-19	6- 7-79	- 500	71	85	0.32	< 0.1	< 0.03	6.3	7.2	900
W-20	6- 6-79	- 530	72	26	0.25	< 0.1	< 0.03	11.5	7.1	900
W-21A	6-12-79	- 70	6,600	9,500	6	0.7	< 0.03	448,000	6.1	35,000
W-21B	6-12-79	-1,500	8,900	7,450	6.4	0.7	< 0.03	688,000	6.2	35,000
W-21C	6-12-79	-	5.5	150	< 1	-	< 0.19	835×10^6	7.2	50
W-22	6- 8-79	- 300	70	16	0.64	< 0.1	< 0.03	19.3	6.7	950

Note: pH and specific conductance taken in the field; other parameters analyzed by Penn Environmental Consultants, Inc., Pittsburgh, Pennsylvania

Table C-1. (Continued)

Well No.	Date	Acidity (mg/l as $CaCO_3$)	Sulfate (mg/l)	Chloride (mg/l)	Fluoride (mg/l)	Antimony (mg/l)	Arsenic (mg/l)	Carbon-Tetra-chloride (ug/l)	pH	Specific Conductance (umhos/cm)
W-23	6- 8-79	- 390	88	12	0.33	< 0.1	< 0.03	3.9	7.2	700
W-24	6- 7-79	- 380	87	65	0.28	< 0.1	< 0.03	14.3	7.1	950
W-25	6- 8-79	-1,000	59	950	0.37	< 0.1	< 0.03	386	7.1	5,000
W-26	6- 8-79	- 560	110	5.5	0.42	< 0.1	< 0.03	11.4	7.0	1,200
W-27	6- 8-79	- 350	110	30	0.54	< 0.1	< 0.03	42.3	7.1	850
W-28	6- 8-79	- 560	55	28	0.21	< 0.1	< 0.03	5.8	7.1	1,000
W-29	6- 8-79	- 320	90	550	2.6	< 0.1	< 0.03	379	7.1	2,950
W-30	6- 6-79	- 570	120	40	0.22	< 0.1	< 0.03	14.1	7.1	900
W-31	6-11-79	- 480	160	225	10	0.4	0.03	8,350	7.2	1,600
W-32	6-11-79	-1,160	710	2,675	4.8	0.3	< 0.03	23,500	6.4	16,500
W-33	6-12-79	-2,000	2,100	40,000	52	0.9	< 0.03	96,480	8.7	40,000
W-34	6-12-79	- 510	8,500	900	0.54	0.3	< 0.03	114,000	6.3	18,000
W-35	6-12-79	-5,500	7,300	1,280	96	0.3	< 0.03	322,000	6.6	25,000
W-36	6-11-79	-1,070	2,500	90	4.8	0.4	< 0.03	328,000	6.3	27,500
W-37	6-11-79	- 360	130	16	4.0	< 0.1	< 0.03	399	6.8	5,250
W-38	6-12-79	-2,800	1,300	28	8.2	0.2	< 0.03	328,000	6.8	10,500
W-39	6-12-79	- 106	880	1,450	2.3	0.3	< 0.03	336,000	6.8	16,500
W-40	6-11-79	- 75	180	2,700	0.62	1.2	< 0.03	7,070	6.2	37,500
W-41	6-11-79	- 51	110	715	0.74	< 0.1	< 0.03	680	7.0	2,950
Dug Well	6- 6-79	- 500	73	28	0.21	0.1	0.03	1,350	7.4	950

Note: pH and specific conductance taken in the field; other parameters analyzed by Penn Environmental Consultants, Inc., Pittsburgh, Pennsylvania.

Geraghty & Miller, Inc.

Table C-2. Analyses of Ground-Water Samples Taken at the Allied Chemical Corporation Plant, Danville, Illinois, in August 1979.

Well No.	Date	Acidity (mg/l as $CaCO_3$)	Sulfate (mg/l)	Chloride (mg/l)	Fluoride (mg/l)	Antimony (mg/l)	Arsenic (mg/l)	Carbon Tetra-chloride (ug/l)	pH	Specific Conductance (umhos/cm)
W- 1	8-17-79	- 320	102	101	0.45	0.3	< 0.03	619	7.2	1,000
W- 2	8-17-79	- 270	167	330	0.22	< 0.1	< 0.03	< 1	7.3	1,600
W- 3	8-17-79	- 460	144	56	0.27	< 0.1	< 0.03	1.8	7.3	850
W- 4S	8-17-79	- 310	66	35	0.31	< 0.1	< 0.03	< 1	7.4	750
W- 4D	8-17-79	- 490	414	20	0.23	0.4	< 0.03	< 1	7.0	1,500
W- 5	8-17-79	- 710	294	3,700	0.27	0.2	< 0.03	4.6	6.9	8,500
W- 6	8-17-79	-13,000	518	230	500	0.6	< 0.03	< 1	10.2	45,000
W- 7	8-17-79	- 860	335	6,400	14	0.4	< 0.03	< 1	6.3	15,000
W- 8	8-17-79	- 140	46	390	13	< 0.1	< 0.03	< 1	6.5	1,600
W- 9	8-17-79	- 250	64	230	19	< 0.1	< 0.03	7.2	6.9	1,300
W-10	8-18-79	- 7,300	437	76	330	0.3	< 0.03	< 1	9.8	35,000
W-11	8-18-79	+ 80	1,033	4,600	3.6	0.5	< 0.03	1,138,000	5.6	12,000
W-12	8-18-79	- 510	166	3,350	14	0.4	< 0.03	2.6	7.4	10,000
W-13	8-17-79	- 130	43	170	0.69	0.1	< 0.03	3.6	7.5	900
W-14	8-17-79	- 270	114	610	0.26	< 0.1	< 0.03	5.9	6.7	2,700
W-15	8-16-79	- 360	125	220	0.31	< 0.1	< 0.03	5	7.3	1,500
W-16	8-16-79	- 360	82	240	0.38	< 0.1	< 0.03	< 1	7.2	1,000
W-17	8-16-79	- 240	80	240	0.25	< 0.1	< 0.03	< 1	7.3	1,200
W-18	8-16-79	- 170	36	220	0.23	< 0.1	< 0.03	1.8	7.1	1,200
W-19	8-16-79	- 220	60	120	0.26	< 0.1	< 0.03	8.6	7.3	900
W-20	8-16-79	- 350	93	25	0.25	0.2	< 0.03	5.1	7.2	900
W-21A	8-19-79	- 5	7,245	9,200	4.90	0.8	< 0.03	215,000	6.0	30,000
W-21B	8-20-79	- 1,200	93,610	7,800	8	0.7	< 0.03	143,470	6.4	28,000
W-21C	8-20-79	-	-	-	-	-	-	> 5×10^8	-	-
W-22	8-17-79	- 440	81	25	0.20	< 0.1	< 0.03	3.5	6.9	900

Note: pH and specific conductance taken in the field, other parameters analyzed by Penn Environmental Consultants, Inc Pittsburgh, Pennsylvania.

Table C-2. (Continued)

Well No.	Date	Acidity (mg/l as $CaCO_3$)	Sulfate (mg/l)	Chloride (mg/l)	Fluoride (mg/l)	Antimony (mg/l)	Arsenic (mg/l)	Carbon Tetra-chloride (ug/l)	pH	Specific Conductance (umhos/cm)
W-23	8-16-79	- 300	154	30	0.34	0.2	< 0.03	< 1	7.3	700
W-24	8-16-79	- 250	77	76	0.23	0.2	< 0.03	1.4	6.7	700
W-25	8-16-79	- 300	121	1,900	0.49	0.2	< 0.03	241	6.5	5,000
W-26	8-18-79	- 340	98	110	0.35	< 0.1	< 0.03	< 1	7.0	1,200
W-27	8-19-79	- 320	62	45	0.49	< 0.1	< 0.03	2.4	7.0	850
W-28	8-16-79	- 400	62	40	0.18	< 0.1	< 0.03	< 1	6.8	900
W-29	8-16-79	- 190	106	750	0.35	< 0.1	< 0.03	16	6.6	2,600
W-30	8-16-79	- 290	99	35	0.17	< 0.1	< 0.03	3.1	6.9	800
W-31	8-18-79	- 190	151	560	11	< 0.1	0.11	77,500	6.5	2,200
W-32	8-19-79	- 220	501	7,100	5.5	< 0.3	< 0.03	13,420	6.0	6,000
W-33	8-19-79	-9,100	2,484	8,400	61	0.5	0.41	33,600	12.4	28,000
W-34	8-20-79	- 330	9,521	2,000	4.2	0.7	0.28	230,000	6.1	15,500
W-35	8-20-79	-2,900	9,790	1,500	210	0.6	0.14	72,000	7.5	20,000
W-36	8-19-79	- 95	2,369	8,900	5.1	0.5	< 0.03	124,400	5.8	27,000
W-37	8-19-79	- 150	134	3,600	3.1	0.5	< 0.03	100	6.3	9,500
W-38	-	-	Removed in August 1979 during construction activities					-	-	-
W-39	8-20-79	- 500	748	3,600	2.6	0.4	< 0.03	230,000	5.9	7,000
W-40	8-18-79	+ 30	175	12,800	0.12	1.6	< 0.03	6,700	5.8	27,000
W-41	8-15-79	- 220	102	960	0.33	< 0.1	< 0.03	105	6.3	3,000
Dug Well	8-16-79	- 400	193	35	0.20	< 0.1	< 0.03	< 1	6.8	750

Note: pH and specific conductance taken in the field; other parameters analyzed by Penn Environmental Consultants, Inc., Pittsburgh, Pennsylvania.